US011771413B2

(12) **United States Patent**
Rajek

(10) **Patent No.: US 11,771,413 B2**
(45) **Date of Patent: Oct. 3, 2023**

(54) **RETRACTOR BLADE DEVICES AND RELATED METHODS**

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(*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 0 days.

(21) Appl. No.: **17/563,520**

(22) Filed: **Dec. 28, 2021**

(65) **Prior Publication Data**

US 2022/0202404 A1 Jun. 30, 2022

Related U.S. Application Data

(60) Provisional application No. 63/131,707, filed on Dec. 29, 2020.

(51) **Int. Cl.**
A61B 17/02 (2006.01)

(52) **U.S. Cl.**
CPC ***A61B 17/025*** (2013.01); *A61B 2017/0256* (2013.01)

(58) **Field of Classification Search**
CPC A61B 17/025; A61B 2017/0256; A61B 17/02
USPC 600/184–245
See application file for complete search history.

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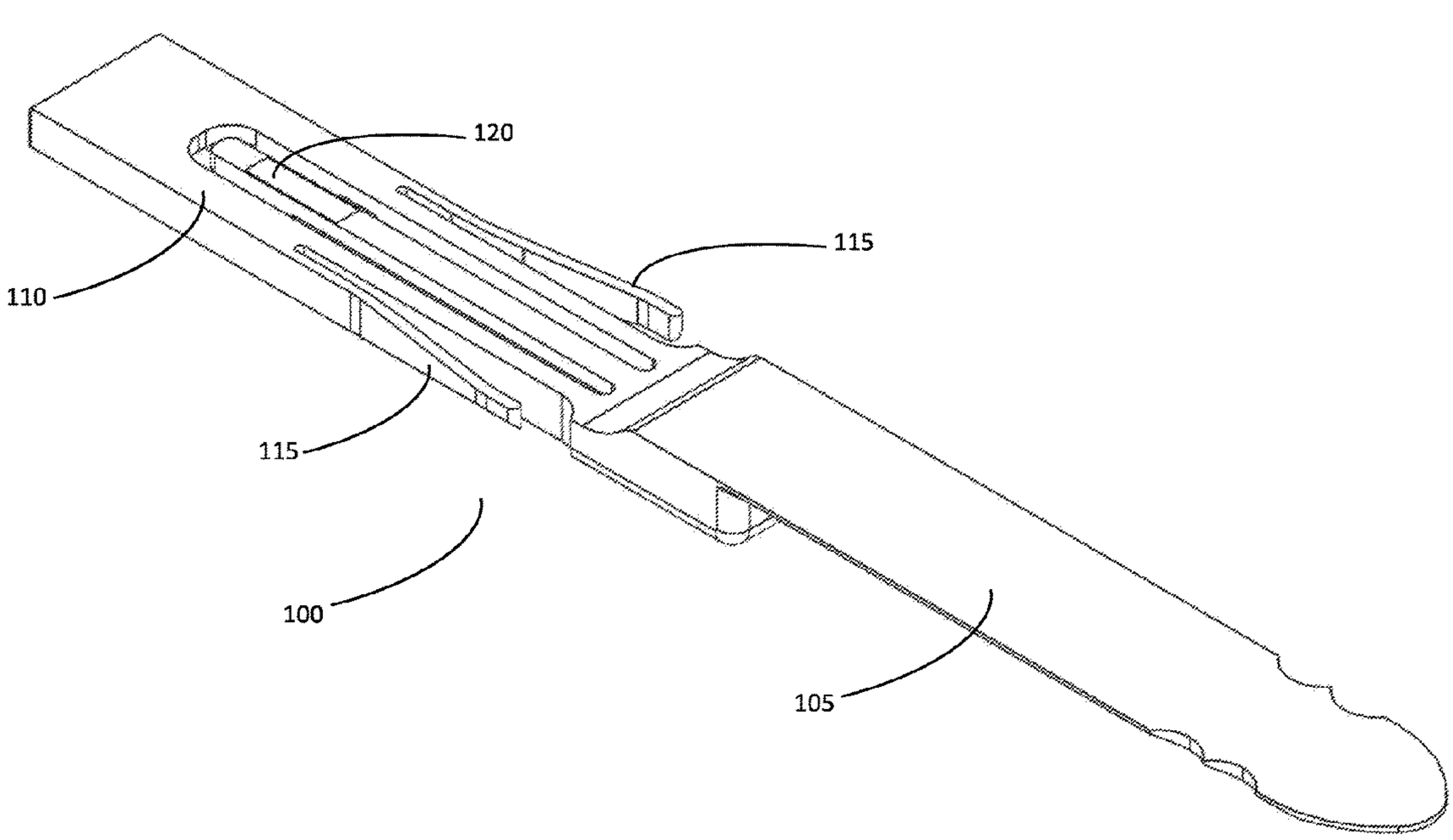
(57) **ABSTRACT**

Disclosed herein are retractor blade devices, such as blade extenders and tissue shims, as well as drivers and kits for utilizing such retractor blade devices. Exemplary retractor blade devices include a retractor blade engagement portion having a body portion configured to sit at least partially in a channel of a retractor blade. The body portion has a first retention component extending therefrom. Exemplary retractor blade devices also include an extension portion extending from the body portion of the retractor blade engagement portion.

20 Claims, 8 Drawing Sheets



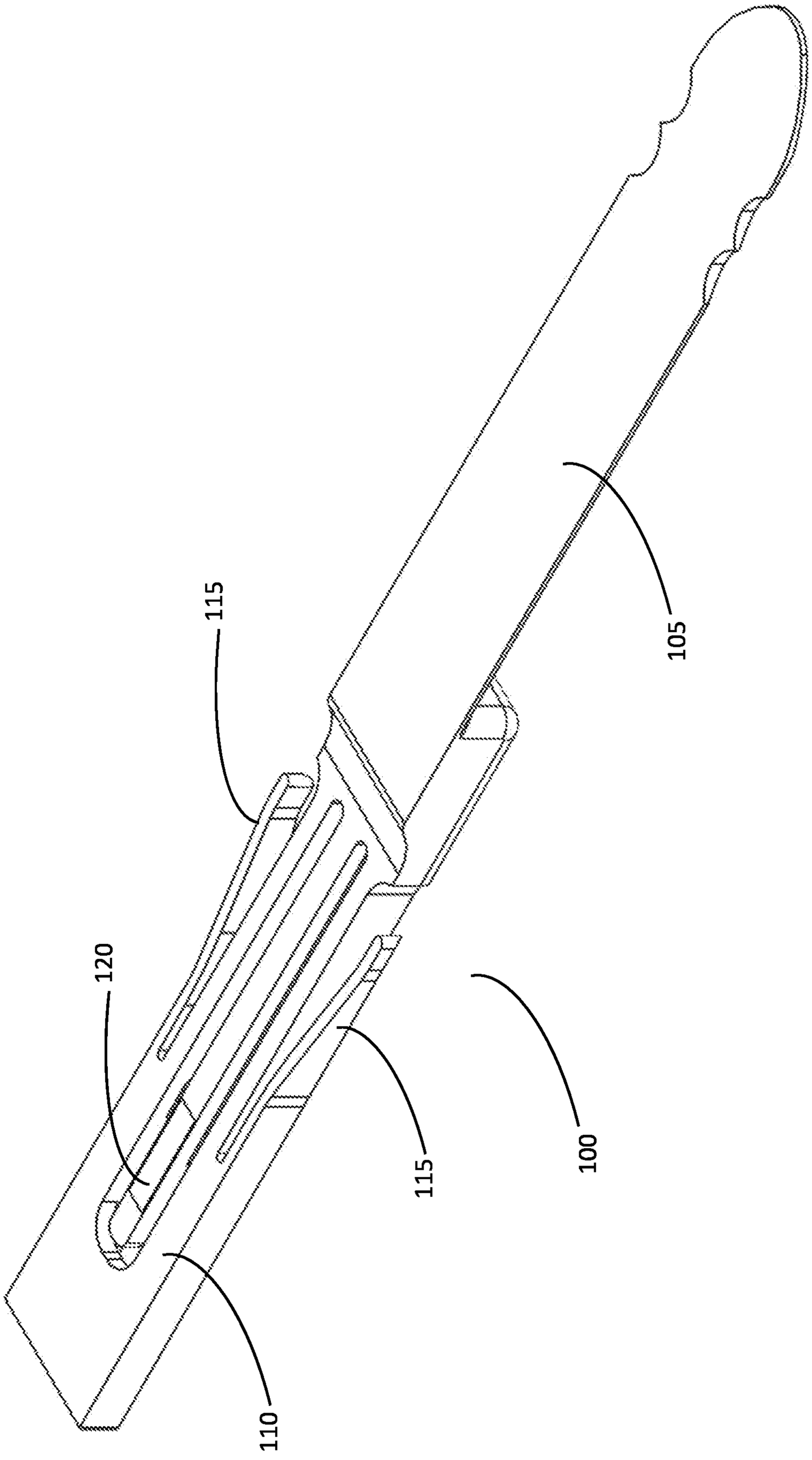


FIG. 1A

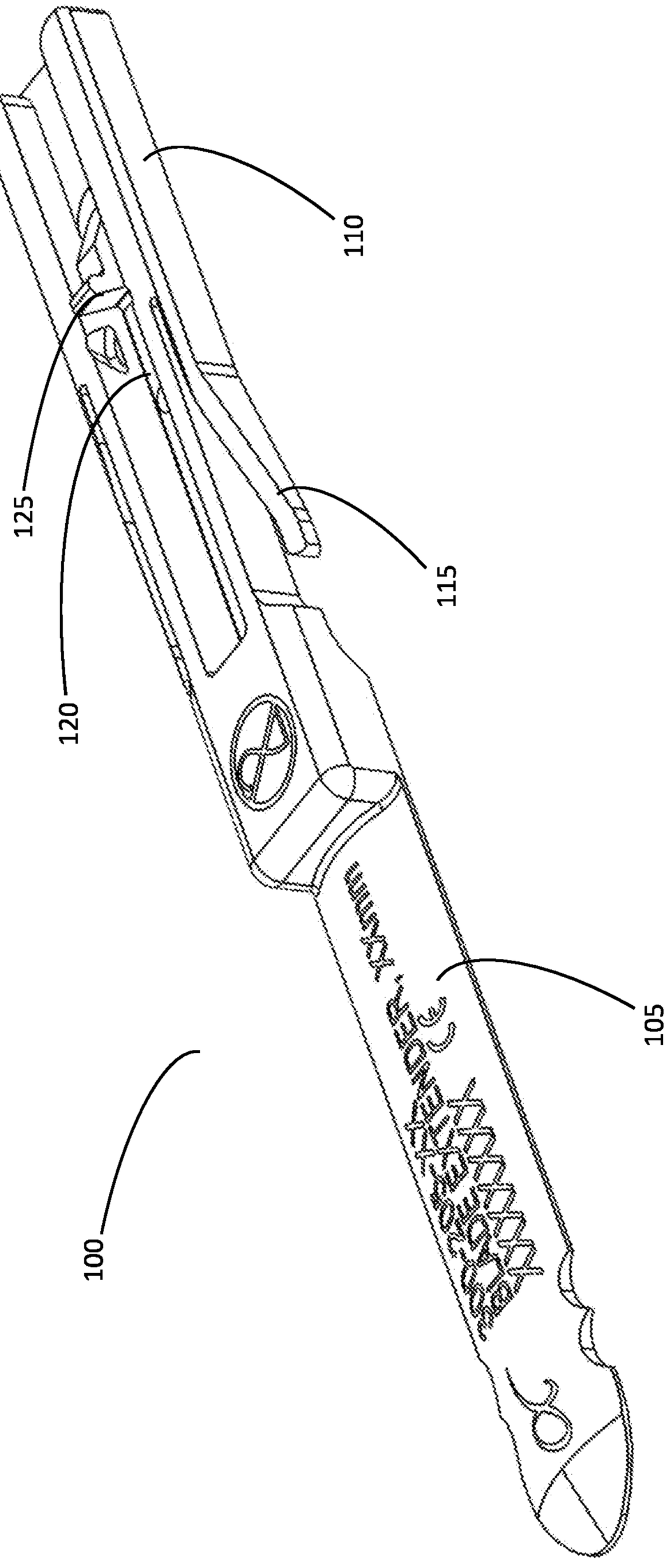


FIG. 1B

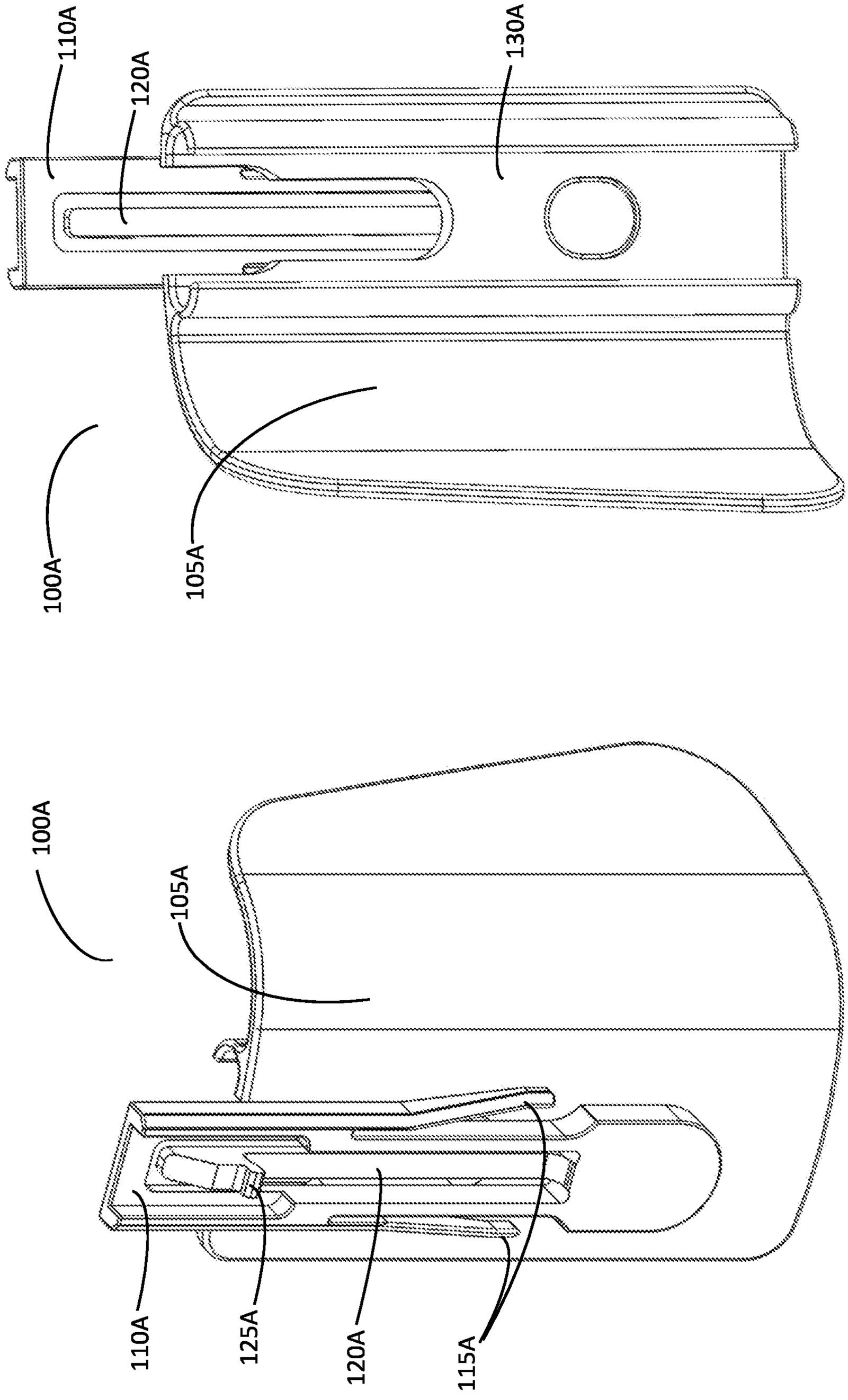


FIG. 2B

FIG. 2A

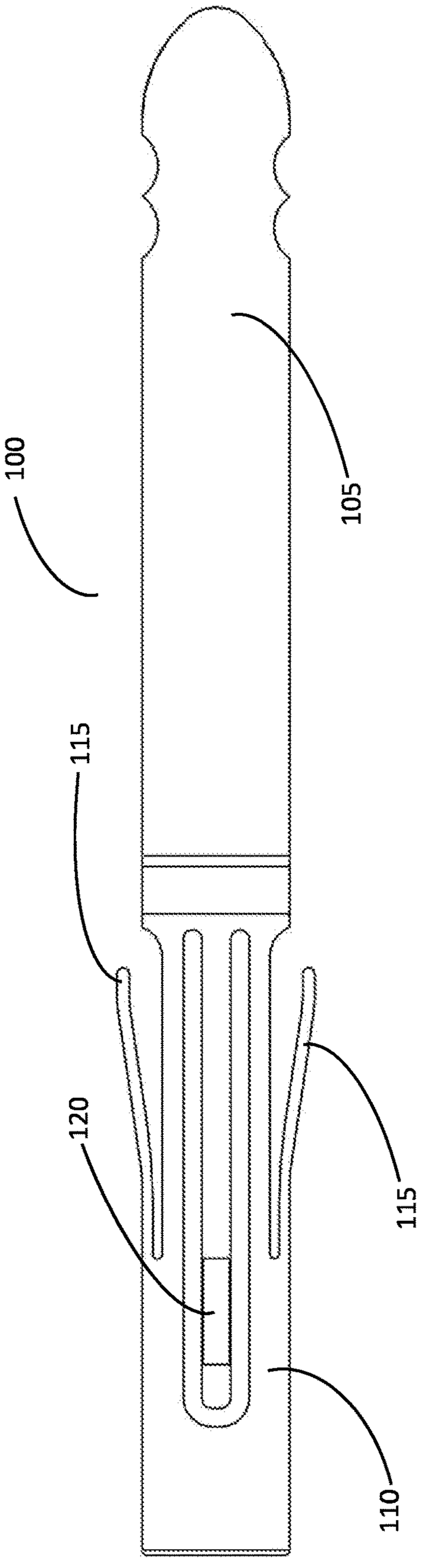


FIG. 3A

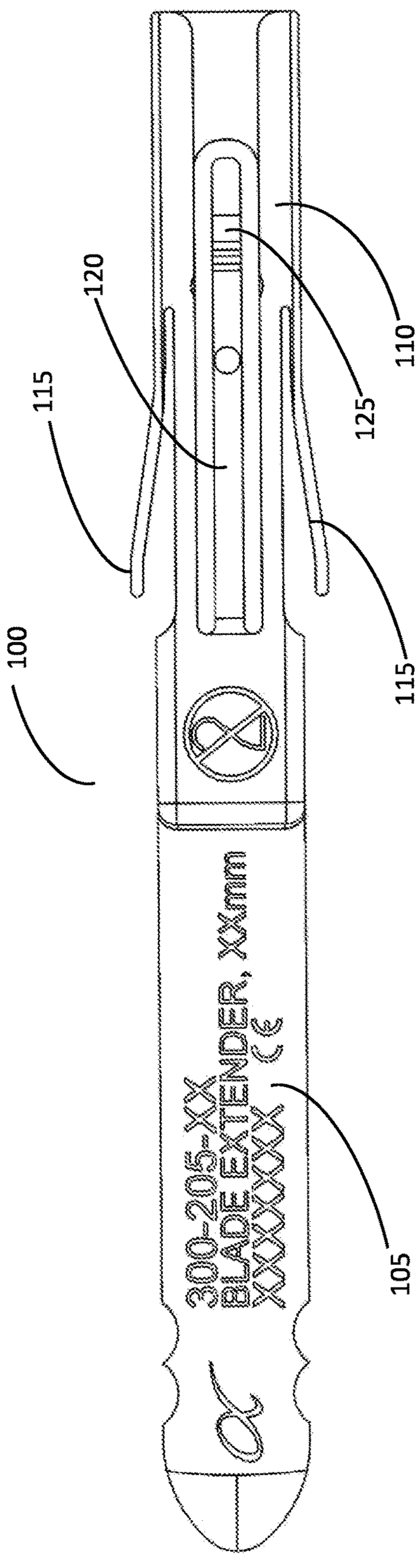


FIG. 3B

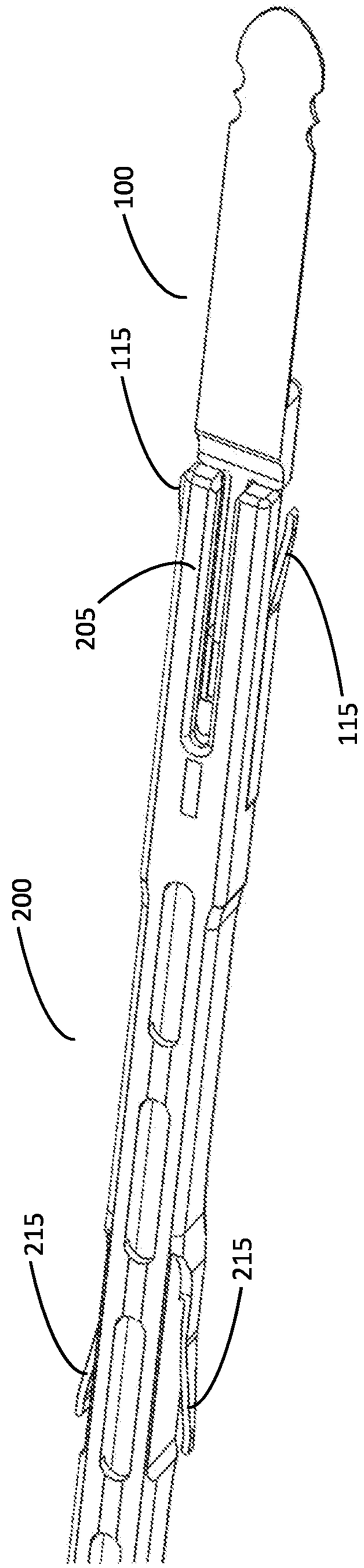


FIG. 4A

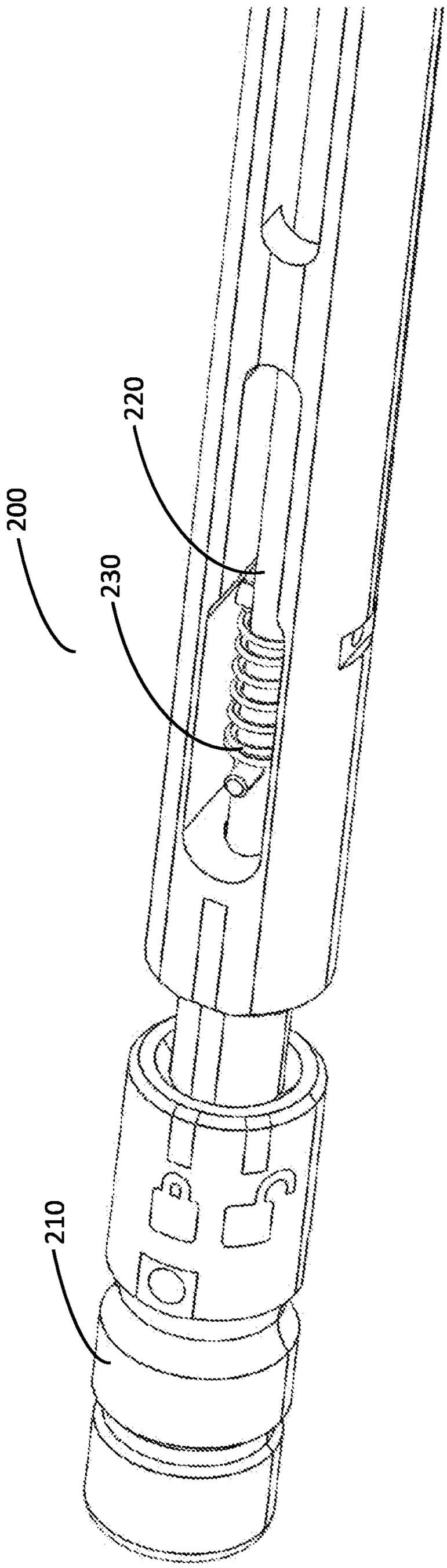


FIG. 4B

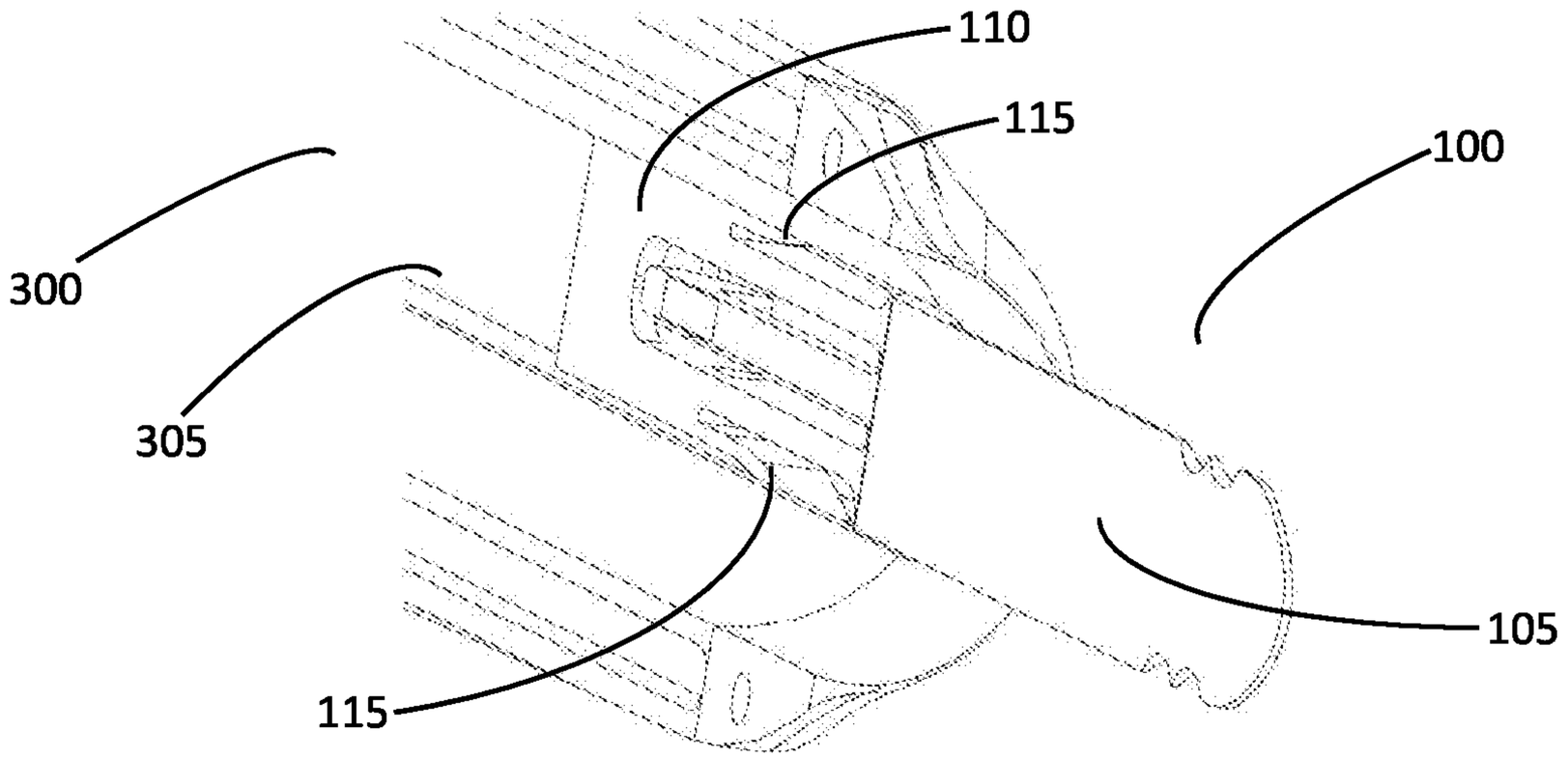


FIG. 5A

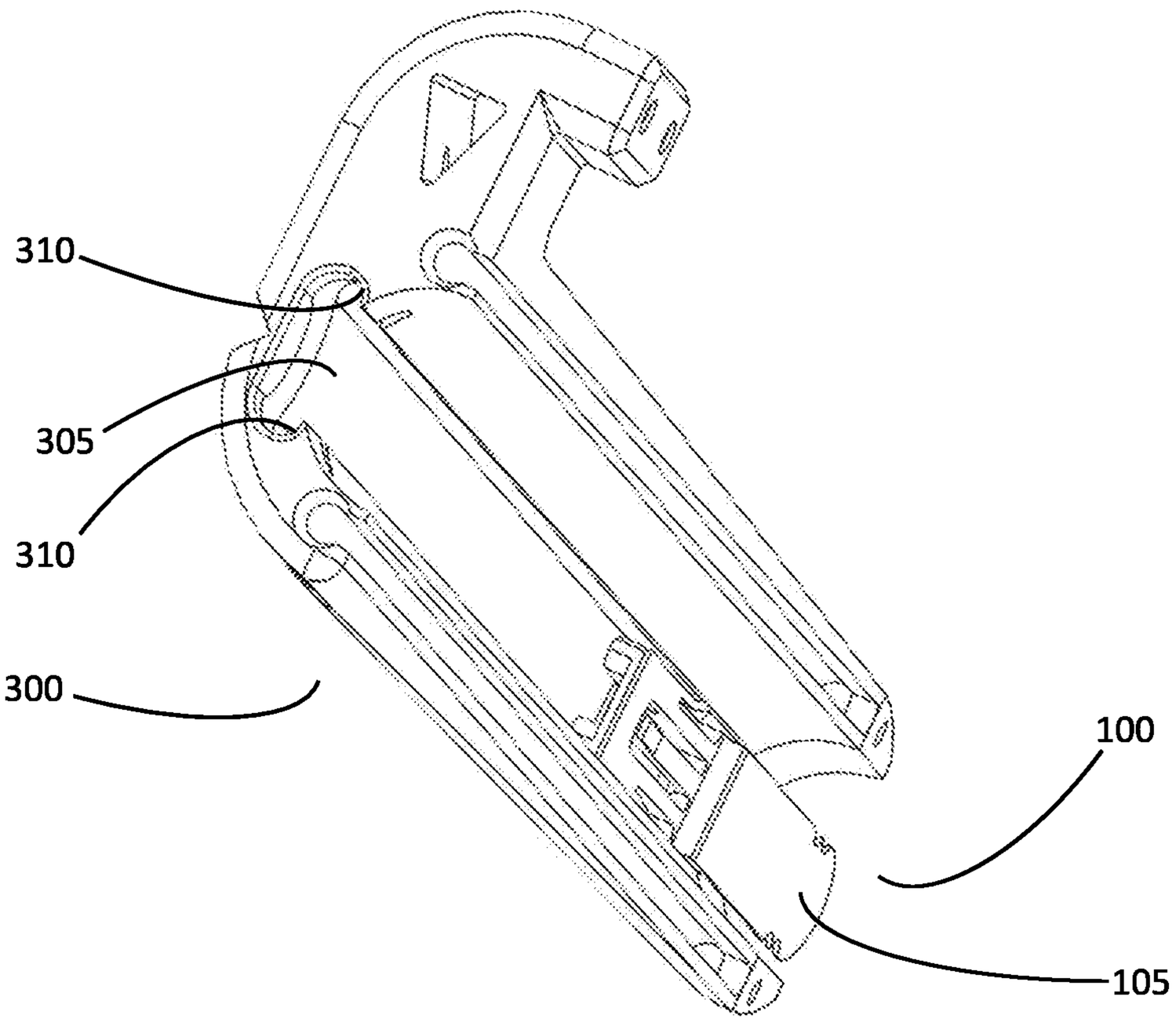


FIG. 5B

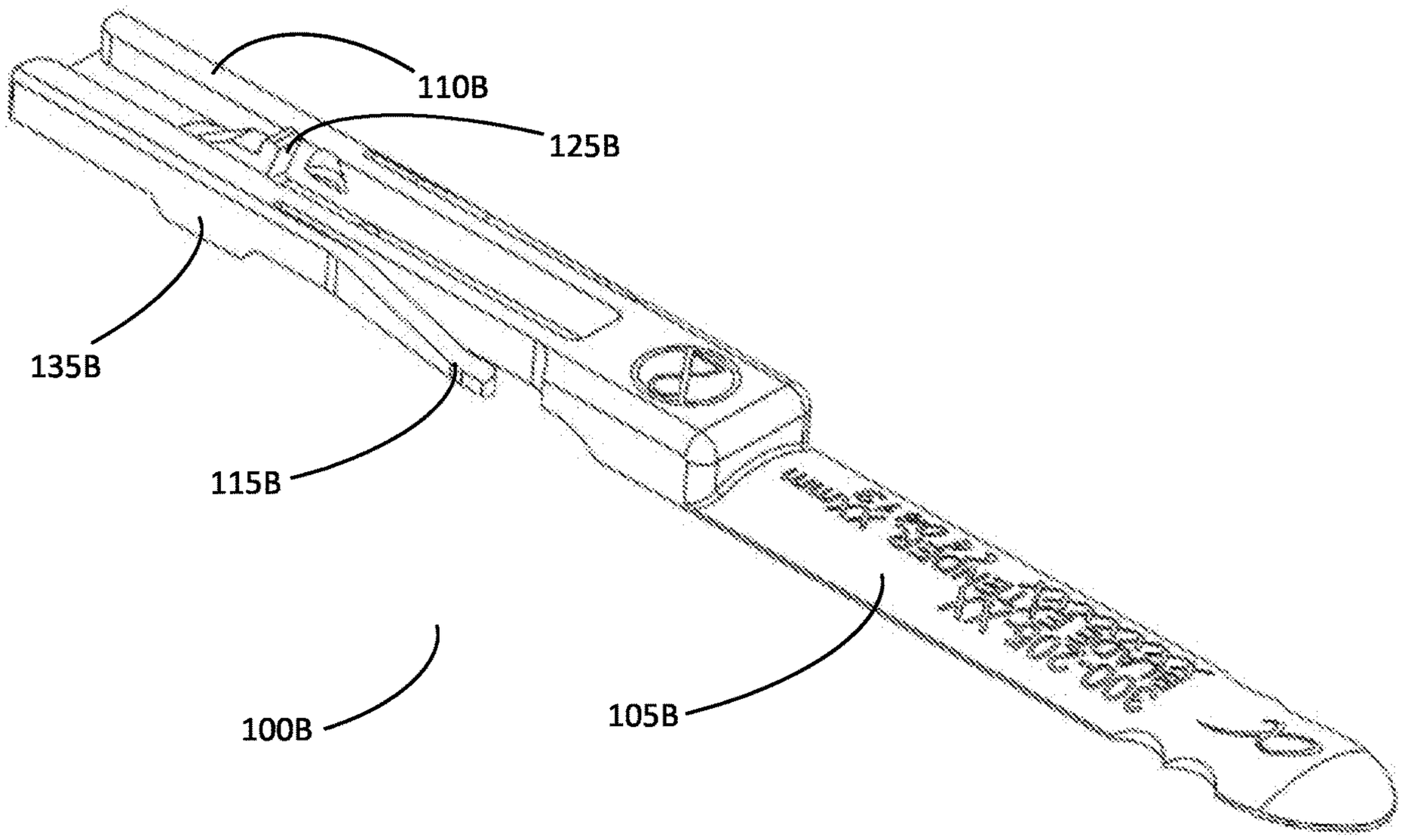

110B
125B
135B
115B
100B
105B

FIG. 6

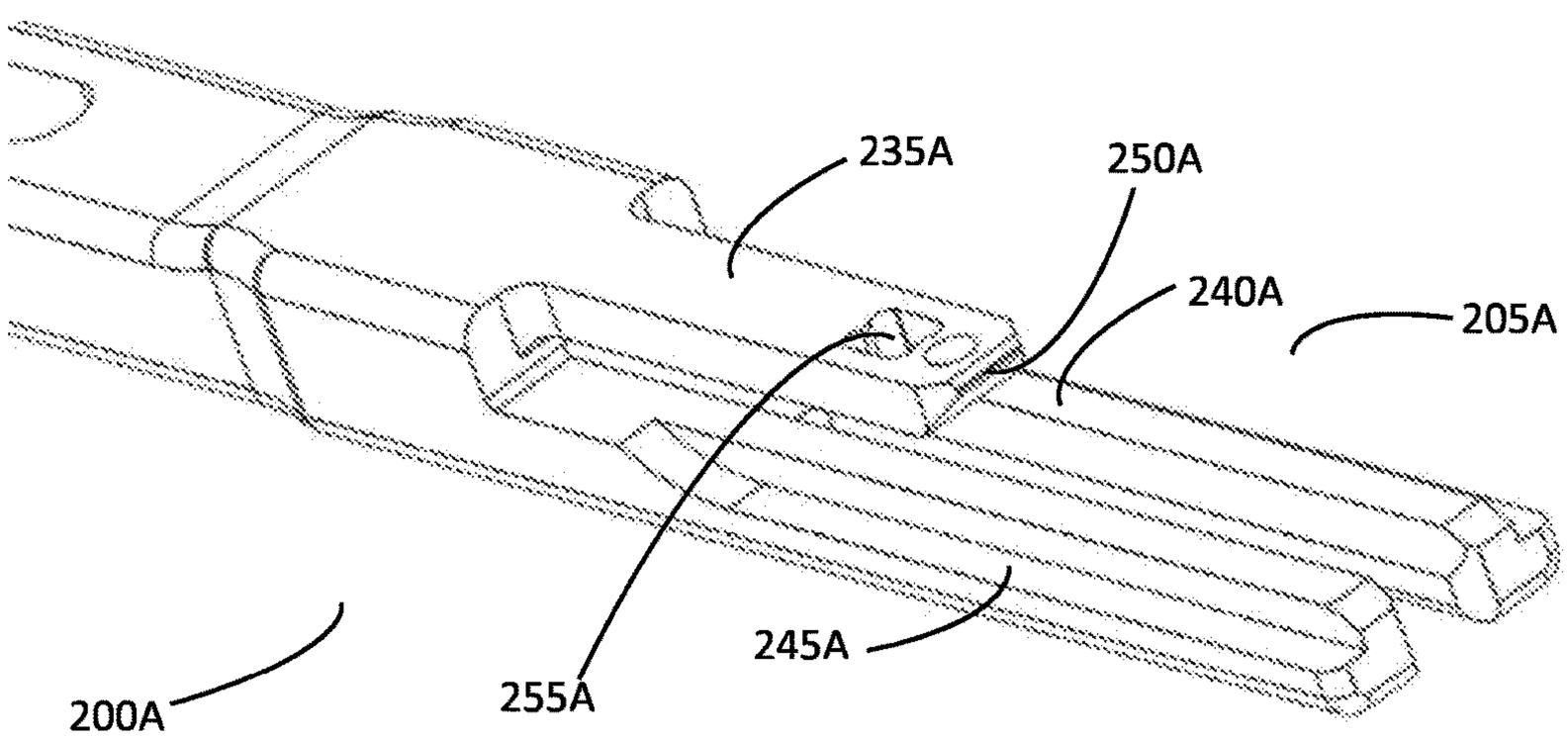

235A
250A
240A
205A
245A
200A
255A

FIG. 7

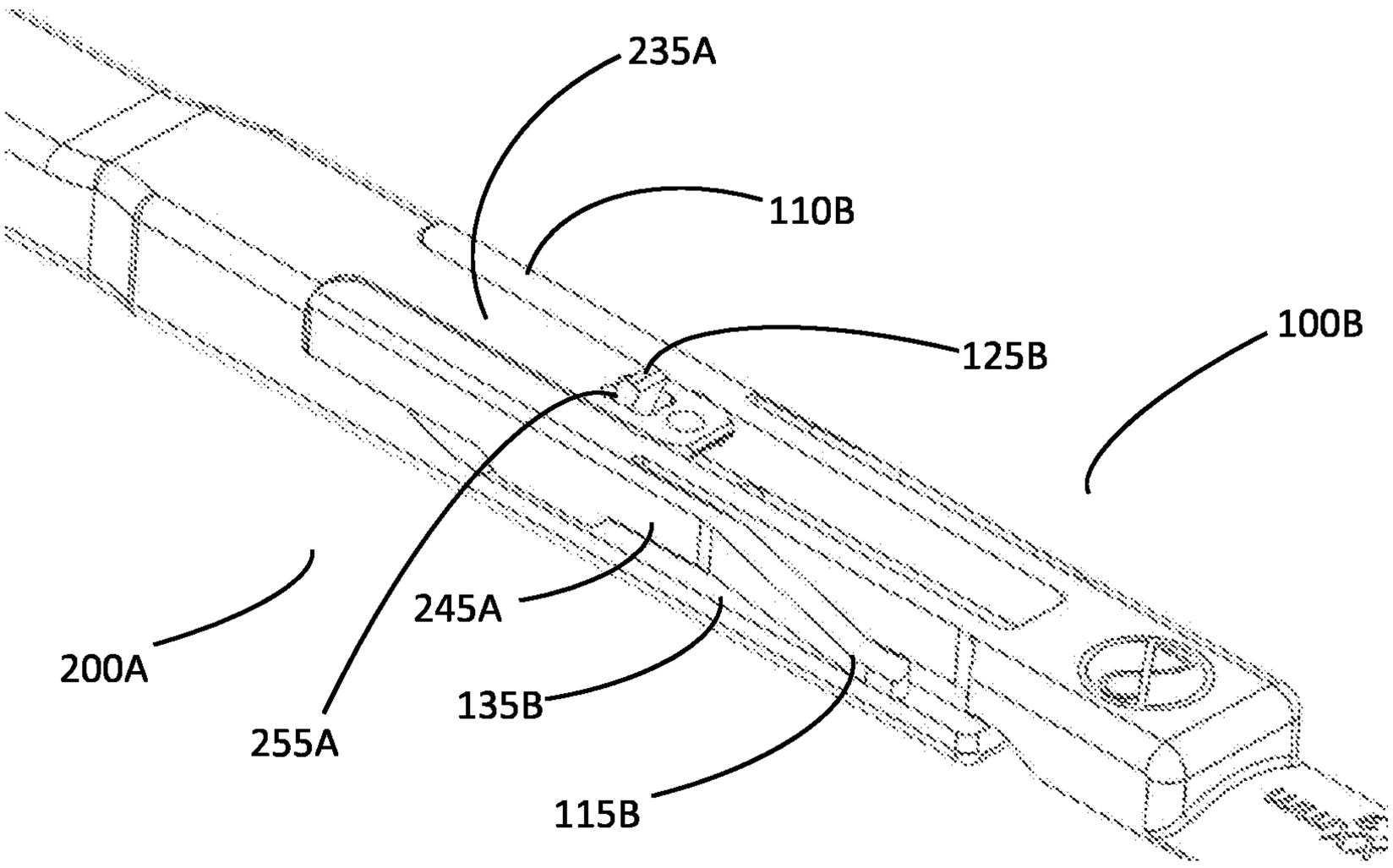


FIG. 8

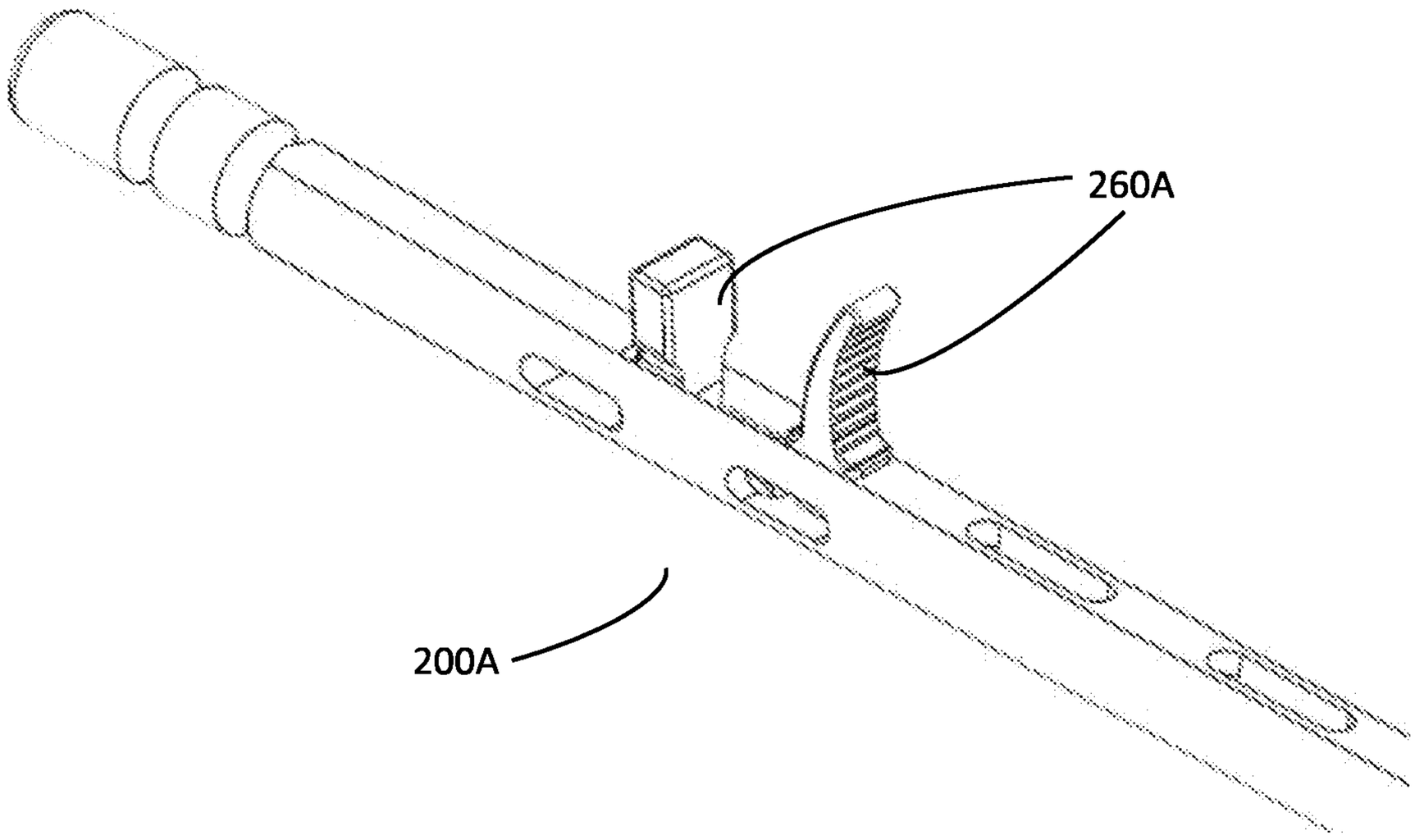


FIG. 9

RETRACTOR BLADE DEVICES AND RELATED METHODS

CROSS-REFERENCE TO RELATED APPLICATIONS

This application claims priority to U.S. Provisional Application No. 63/131,707, filed Dec. 29, 2020, the entire contents of which are incorporated herein by reference.

FIELD OF THE TECHNOLOGY

The present disclosure generally relates to medical devices for retracting tissue and creating and maintaining a surgical corridor. In particular, disclosed herein are embodiments of an instrument that may be used to help create and maintain a surgical corridor that can also be secured to the blade of a surgical retractor positioned in the surgical corridor.

BACKGROUND

Retractor systems may be used in a variety of different surgical procedures to provide an opening through which a surgeon may access the surgical site. In spinal surgeries, for example, a retractor system may be used to provide the surgeon with access to the patient's spine. The opening created by the retractor system may, for example, enable the surgeon to access the patient's spine to manipulate the spine and secure implants in or on the spine. Common retractor systems may include a plurality of blades coupled to a retractor frame. In use, the blades may be inserted into an incision and then retracted to displace tissue surrounding the incision down to the surgical site thereby creating a surgical corridor. However, despite the ability to maneuver the blades of some retractor systems, there still exists a need for further manipulation of the tissue particularly after the blades have achieved an initial surgical corridor.

SUMMARY

Disclosed herein are various devices largely for use with surgical retractor blades. Such devices comprise a retractor blade engagement portion and extension or working portion. The engagement portion is configured to be releasably engaged in a channel or track of the retractor blade. The extension or working portion may be shaped or designed to achieve any number of functions, such as but not limited to, the functions of a tissue shim, an intradiscal shim, a blade extender, etc.

According to some embodiments, the retractor blade engagement portion has a body portion with a distal end and a proximal end, and the retractor blade engagement portion is configured to sit at least partially in a channel of a retractor blade. The body portion has at least one retention component extending therefrom configured to engage the channel or track of the retractor blade. Some embodiments have two retention components.

The extension portion may be substantially flat or curved. The extension portion may include a hook feature. The extension portion may be wider than the retractor blade engagement portion. At least a portion of the extension portion may extend laterally of the blade engagement portion. The distal end of the extension portion may extend beyond the distal end of the blade engagement portion by at least about 0.1 cm, at least about 1 cm, at least about 2 cm, at least about 3 cm, or at least about 4 cm. The proximal end of the extension portion may be positioned at any one of the following positions relative to the proximal and distal ends of the blade engagement portion: (a) proximally of the proximal end; (b) substantially in line with the proximal end; or (c) at a point between the proximal and distal ends.

According to some embodiments, the body portion defines a first plane and the extension portion defines a second plane. The first and second planes may be parallel to each other. The first and second planes may not be coplanar.

According to some embodiments, the retention component(s) comprise(s) a resilient projection. The retention component(s) may extend(s) in a plane coplanar with the body portion. The retention component(s) is (are) configured to allow the retractor blade device to be brought into the retractor blade channel from a position perpendicular to a plane defined by the channel.

According to some embodiments, the distal end of the extension portion has a rounded profile. The extension portion may include at least one scalloped edge.

According to some embodiments, the body portion includes a driver locking mechanism. The driver locking mechanism may include a resilient portion and a projection. The projection may be configured to engage a depression in the retractor blade. The resilient portion may lie substantially in the same plane as the body portion and may extend from a plane defined by the body portion.

According to some embodiments, the extension portion comprises a channel or track extending from a point near the proximal end of the extension portion toward the distal end of the extension portion. The channel or track may be open at its proximal end and/or open at its distal end.

Also disclosed herein device drivers configured to engage a retractor blade device as disclosed herein. Such drivers include a handle, an elongate housing, a shaft contained within the housing, and a receiving portion configured to receive at least a portion of the retractor blade device. The handle is configured to communicate with the shaft to releasably engage the retractor blade device. The receiving portion may be a distal opening in the housing configured to receive at least a portion of the body portion of the retractor blade device.

According to some embodiments, the blade device driver is configured to releasably engage the driver locking mechanism of the retractor blade device. The housing comprises at least one retention component configured to retain the blade device driver in a channel of a retractor blade. Some embodiments include two retention components. The retention component(s) may be configured to allow the blade device driver to be brought into the channel from a position perpendicular to a plane defined by the channel. The handle may be configured to occupy a locked position that allows compaction forces to be transferred from the handle through the housing and directly to the retractor blade device.

Also disclosed herein are retractor blade kits that include a retractor blade and a retractor blade device, such as those disclosed herein. The retractor blade may define a plane and has a proximal end and a distal end and includes a channel extending from the proximal end toward the distal end. The retractor blade device is configured to be engaged with the channel by inserting at least a portion of the retractor blade device into the channel at a point away from the proximal end of the retractor blade.

According to some embodiments of retractor blade kits, the channel is closed at the distal end of the retractor blade. The channel may be open at the proximal end of the retractor blade. The retractor blade device may be further configured to be engaged with the channel by inserting at least a portion

of the retractor blade device into the channel by accessing the opening of the channel at the proximal end of the retractor blade. Some embodiments further include a blade device driver configured to engage with at least a portion of the retractor blade device. The blade device driver may be further configured to manipulate the movement of the retractor blade device and engage the retractor blade device with the channel of the retractor blade.

Also disclosed herein are methods of using a retractor blade device in conjunction with a surgical retractor having at least one or more retractor blades. Such methods include engaging the retractor blade device with a channel of a retractor blade by inserting at least a portion of the retractor blade device into the channel at a point distal to a proximal end of the channel. Engaging the retractor blade device with the channel of the retractor blade may comprise moving at least a portion of the retractor blade device in a direction normal to a plane defining the channel. Engaging the retractor blade device with the channel of the retractor blade may comprise engaging at least a portion of the retractor blade device with one or more depressions in the channel of the retractor blade. The retractor blade may be positioned within a surgical opening of a patient so as to create a surgical corridor prior to the retractor blade device being engaged with the channel on the retractor blade. Some methods further include sweeping the surgical corridor and/or a surgical site of interfering tissue with the retractor blade device prior to the retractor blade device being engaged with the channel of the retractor blade. Some methods include the use of a blade device driver to insert the retractor blade device into the surgical corridor, manipulate the movement of the retractor blade device in the surgical corridor, and/or engage the retractor blade device with the channel of the retractor blade. Some methods further include toeing out the retractor blade while simultaneously advancing the retractor blade device distally along the channel of the retractor blade. Some methods further include detaching the blade device driver from the retractor blade device so as to leave the retractor blade device in the channel of the retractor blade while removing the blade device driver from the surgical corridor. Removing the blade device driver from the surgical corridor may include sliding the blade device driver proximally along the channel of the retractor blade and out a proximal opening of the channel.

These and other features are disclosed in greater detail in the accompanying figures and the Detailed Description below.

BRIEF DESCRIPTION OF THE DRAWINGS

The embodiments set forth in the drawings are illustrative and exemplary in nature and not intended to limit the subject matter defined by the claims. The following detailed description of the illustrative embodiments can be better understood when read in conjunction with the following drawings wherein like structure is indicated with like reference numerals and in which:

FIGS. **1**A and **1**B are perspective views of an embodiment of a retractor blade device according to the present disclosure;

FIGS. **2**A and **2**B rear and front views of another embodiment of a retractor blade device according to the present disclosure.

FIGS. **3**A & **3**B are front and back views, respectively, of the retractor blade device of FIG. **1**A;

FIG. **4**A is a perspective view of the retractor blade device of FIG. **1**A coupled to a driver.

FIG. **4**B is a perspective view of a portion of the driver of FIG. **4**A.

FIG. **5**A is a perspective view of the distal end of a retractor blade with the retractor blade device of FIG. **1**A secured therein;

FIG. **5**B is a perspective view of the retractor blade of FIG. **5**A with the retractor blade device of FIG. **1**A secured therein;

FIG. **6** is a perspective view of another embodiment of retractor blade device according to the present disclosure;

FIG. **7** is a perspective view of a distal end of another embodiment of a deployment instrument according to the present disclosure;

FIG. **8** is an enlarged view of a portion of the deployment instrument of FIG. **7** engaged with the retractor blade device of FIG. **6**; and

FIG. **9** is a perspective view of a proximal end of the deployment instrument of FIG. **7**.

DETAILED DESCRIPTION

Disclosed herein are devices that augment or enhance the functionality of some retractor blades. Such devices may be referred to as retractor blade extenders and may be used with drivers to help control or manipulate the extenders or other enhancement devices. Also disclosed are methods of using such enhancement devices to enlarge, restore, and/or maintain a surgical corridor. These enhancement devices are removably attached to retractor blades. Such devices may be used to pull back and maintain tissue that has crept into a surgical corridor. Such devices may be used to functionally increase the size of the retractor blade, thereby increasing the amount of tissue that can be held in place. Such devices may be used to temporarily anchor the retractor blade relative to a disc space.

FIGS. **1**A and **1**B illustrate perspective views of one such enhancement device, a retractor blade extender **100**, according to the present disclosure. Retractor blade extender **100** may be referred to herein as a blade extender or simply an extender. A skilled artisan will understand that the features of blade extender **100** discussed herein could be applied to any number of suitable enhancement devices, such as a tissue shim or a tissue hook, etc. as discussed below.

Blade extender **100**, as illustrated, has both an extension portion **105** and a blade engagement portion **110**, sometimes called a driver engagement portion, where blade engagement portion **110** is configured to be secured in and, and in some embodiments, translate along a channel of a retractor blade, such as that shown in FIGS. **5**A and **5**B. In some embodiments, blade engagement portion **110** is further configured to lock in place in the retractor blade channel.

Extension portion **105** comprises an elongate body that is relatively flat like a blade, the distal end of which is rounded, which may help when inserting blade extender **100** into a surgical corridor and/or when blade extender is used to push or pull tissue away from the surgical site and hold it back as will be discussed in greater detail below. Elongate portion **105** may have blade-like edges with a portion of the edge on either side being scalloped and/or serrated, as illustrated. In some embodiments, the edges of elongate portion **105** are sharp enough to allow for elongate portion to be at least partially inserted into a disc space, for example, to serve as a temporary anchor for a retractor blade. In some embodiments, the edges of elongate portion **105** are not so sharp as to undesirably sever tissue in the surgical corridor.

FIG. **1**A illustrates that elongate portion **105** and blade engagement portion **110** each define a plane. In this illus-

trated embodiment and in others, the respective planes are parallel to each other but no coplanar. This offset between elongate portion **105** and blade engagement portion **110** may provide a bottoming out feature when paired with a retractor blade. In other words, when blade engagement portion **110** is secured in a channel of a retractor blade, if that channel has a closed distal end, blade engagement portion **110** will extend no further than that closed distal end; however, elongate portion **105** will extend beyond the distal end of the channel and, in some embodiments, beyond the distal end of the retractor blade (as illustrated in FIG. **5**A). However, in some embodiments, blade engagement portion **110** and elongate portion **105** are coplanar, and in some embodiments—whether or not coplanar—the respective planes defined by blade engagement portion **110** and elongate portion **105** are not parallel but exhibit a slight angle between them or, in some embodiments, a substantial angle.

Elongate portion **105** is illustrated as being relatively flat; however, in some embodiments elongate portion **105** exhibits a curvature, such as a curvature corresponding to the shape of the surgical corridor.

FIGS. **2**A and **2**B illustrate one variation on blade extender **100**, which may be referred to as a tissue shim **100**A. Similar to blade extender **100**, tissue shim **100**A includes a blade engagement portion **110**A having two engagement tabs **115**A and a locking tab **120**A with a projection **125**A. The function of these features will be largely similar to the function of the corresponding features of blade extender **100** as discussed herein as would be readily apparent to a skilled artisan. However, tissue shim **100**A includes a shim portion **105**A that differs from elongate portion **105** not only in that it does not extend as far beyond blade engagement portion **110**A but also because of the lateral surfaces that extends well beyond the lateral edge of blade engagement portion **110**A and includes a substantial curvature. Shim portion **105**A could be located on either side or on both sides of blade engagement portion **110**A and could exhibit any number of different shapes and curvatures as may be desired for specific needs and surgical procedures.

FIG. **2**B illustrates that tissue shim **100**A further includes an auxiliary channel **130**A that may be used in lieu of the channel of the retractor blade that is occupied with tissue shim **100**A. Additionally, auxiliary channel **130**A is shown as extending beyond the distal end of blade engagement portion **110**A. Thus, auxiliary channel **130**A may serve to create a functional channel further into the surgical corridor and, therefore, closer to the surgical site. In some embodiments, auxiliary channel **103**A may be used by blade extender **100**, thereby functionally combining both tissue shim **100**A and blade extender **100**.

Returning to blade extender **100**, FIGS. **3**A and **3**B illustrate elongate portion **105** as having substantially the same width as blade engagement portion **110**; however, in some embodiments, elongate portion **105** is substantially wider than blade engagement portion **110** so as to provide a greater surface area against the encroachment of tissue into the surgical corridor. In such embodiments, elongate portion **105** does not extend much beyond the distal end of the retractor blade, and the increased width may not necessarily be centered relative to the retractor blade. For example, one lateral side of the elongate portion **105** may extend outwardly greater than the opposite lateral side of the elongate portion **105** such that the width of the elongate portion is not centered relative to the retractor blade.

Elongate portion **105** and blade engagement portion **110** may comprise the same materials or distinct materials. For example, in some embodiments, it is desirable for elongate portion **105** to exhibit some flexibility, whereas engagement portion **110** may need to exhibit less flexibility so as to provide a solid engagement with a retractor blade channel.

Blade engagement portion **110** includes two complimentary extensions or blade engagement tabs **115** that extend laterally from each side of blade engagement portion **110**. In some embodiments, engagement tabs **115** lie in the same plane as blade engagement portion **110**, though in some embodiments one or both of engagement tabs **115** extend at an angle to the plane of blade engagement portion **110**.

Engagement tabs **115** are flexible so as to be able to occupy a natural, unflexed or undeflected configuration where the distal ends of engagement tabs **115** extend beyond the sides of blade engagement portion **110**. Engagement tabs **115** are also configured to flex or deflect toward blade engagement portion **110** so as to occupy a second configuration that brings their respective distal ends closer toward the sides of blade engagement portion **110** or, in other words, in line with the sides of blade engagement portion **110**.

Engagement tabs **115** may comprise the same material as the rest of blade engagement portion **110** or may comprise a distinct material. The material of engagement tabs **115** is preferably a flexible or elastically deformable material. Suitable materials include titanium and steel or alloys thereof as well as one or more plastics or polymers.

FIG. **1**A illustrates blade extender **100** with two engagement tabs **115**, though a skilled artisan will understand that only one locking tab would be required to achieve many of the functional advantages ascribed to blade extender **100**. Similarly, although engagement tabs **115** are shown as being symmetrically placed on each side of blade engagement portion **110**, the tabs may be placed other than symmetrically. Also, in this illustrated embodiment, engagement tabs **115** lie in the same plane as blade engagement portion **110** and further flex or deflect in that same plane. However, in some embodiments, engagement tabs **115** lie in a different plane from blade engagement portion **110** and/or flex or deflect in a distinct plane.

Blade engagement portion **110**, as illustrated embodiment in FIG. **1**B, further includes a driver locking tab **120** configured to releasably engage a driver as will be discussed in greater detail below. Similar to engagement tabs **115**, driver locking tab **120** is flexible or deflectable. In its relaxed or non-deflected state, locking tab **120** lies substantially in the same plane as blade engagement portion **110**, though locking tab **120** includes a projection **125** (also illustrated in FIG. **3**B) extending out of that plane. As will be discussed in greater detail below, projection **125** is configured to engage with a driver that may be used to insert blade extender **100** into a surgical corridor, manipulate blade extender **100** within the corridor to move tissue to the side of the corridor, and to secure blade extender **100** to a retractor blade. Further, in some cases, it will be desirable to drive blade extender **100** into an intradiscal space to help anchor the retractor blade in position relative to the disc space. In some embodiments, projection **125** is configured to engage with depressions in the channel of the retractor blade, thereby fixing blade extender **100** relative to the retractor blade. Such a configuration may be particular useful when blade extender **100** is used as a temporary anchor for the retractor blade. Such depressions may be located along a midline of the channel on the retractor blade, or they may be positioned elsewhere in the channel, such as one either or both sides and even positioned along one or both edges of the channel. Such alternative positions may require a complimentary configuration of locking tab **120** and/or projection **125**.

In some embodiments, engagement tabs **115** may serve the function of locking tab **120**/projection **125**. For example, where the depressions mentioned above are positioned along one or both edges of the channel in the retractor blade, the respective tips of engagement tabs **115** may be configured to engage the depressions, thereby not only maintaining blade device **100** within the channel but also fixing or at least partially fixing its longitudinal position in the channel. In some embodiments, such an arrangement may allow for blade device **100** to translate distally in a passive manner while preventing proximal translation.

As with engagement tabs **115**, locking tab **120** may comprise the same material as or a distinct material from the rest of blade engagement portion **110**. The material of locking tab **120** is preferably a flexible or elastically deformable material. Suitable materials include titanium and steel or alloys thereof as well as one or more plastics or polymers.

Blade extender **100** may be provided in a number of suitable lengths and sizes. A minimum length may be no more than the length required for the blade engagement portion **110** to function properly, which in some embodiments is from 2 cm to about 5 cm. In some embodiments, the total length of blade extender **100** (or **100**A) is from about 2 cm to about 10 cm. In some embodiments, the total length of blade extender **100** is about 5 cm, about 6 cm, about 7 cm, or about 8 cm. The relative lengths of blade engagement portion **110** and elongate portion **105** may be about the same, though in some embodiments, the respective lengths are not the same. For example, in some embodiments, the ratio of the length of elongate portion **105** to the length of engagement portion **110** is greater than 1:2, such as about 1:1, about 1.5:1, about 2:1, or any suitable ratio between those values.

The width of blade extender **100** may be roughly consistent along its length from the proximal end of blade engagement portion **110** to the distal end of elongate portion **105**; however, the width need not be consistent. The width of blade engagement portion **110** is generally chosen based on the width of the channel in a retractor blade or based on the restraining geometry of the retractor blade. For example, the width of blade engagement portion **110** may be substantially smaller or substantially larger than the width of elongate portion **105**. However, whatever the relative widths are, the width of blade engagement portion **110** will generally be less than the width of the channel of the retractor blade; however, the width of engagement tabs **115** will generally be greater than the width of the retractor blade channel when the engagement tabs **115** are in their relaxed or undeflected state.

As has been discussed somewhat already, blade extender **100** may be used to achieve any number of purposes and may be modified to achieve those purposes. Tissue shim **100**A is just one example of a modified version able to engage a retractor blade in the same manner as blade extender **100** but shaped distinctly to block a larger surface area of tissue. Within these two disclosed configurations there exist any number of modifications to shape and size. One such modification is the inclusion of a hook-shaped feature at the distal end of the device. Such a hook-shaped feature may be useful for pulling back tissue in the surgical corridor either to help establish the corridor or to reestablish the corridor.

The ability to disengage the device, whether it be an extender or a shim or some other variation, during a procedure without having to remove the device from the surgical corridor is considered to be one of the greatest benefits of these devices. Additionally, the ability to adjust the depth of the devices as retractor blades are opened or otherwise adjusted is also considered to be an advantageous feature not necessarily known in the art. Such functionality is enhanced with the use of a driver as discussed below.

FIGS. **4**A and **4**B illustrate a driver **200** coupled to blade extender **100**. Driver **200** has a distal end **205** configured to receive at least a portion of blade extender **100**. In this illustrated configuration, blade engagement portion **110** slides into an opening at distal end **205**. In that distal opening, projection **125** of locking tab **120** engages driver **200** to maintain blade extender **100** in a fixed position in driver **200** but leaving engagement tabs **115** exposed so as to engage the channel of a retractor blade as discussed in further detail below.

Similar to blade extender **100**, driver **200** has laterally projecting engagement tabs **215** that, like engagement tabs **115**, are configured to engage the channel of a retractor blade. In this illustrated embodiment, engagement tabs **215** lie in substantially the same plane as driver **200**, but, in some embodiments, one or both of engagement tabs **215** are angled relative the plane of driver **200**. Engagement tabs **215** are useful to help properly position blade extender **100** in a retractor blade channel. Once positioned, driver **200** is disengaged from blade extender **100** to leave blade extender **100** in a retractor blade (as illustrated in FIGS. **5**A and **5**B). In some embodiments, however, driver **200** does not include any locking tabs.

Driver **200** includes a handle **210** at its proximal end and a shaft **220** running from handle **210** toward the distal end of driver **200**. Handle **210**, in this illustrated embodiment, has a lumen into which shaft **220** extends. Spring **230** is configured to maintain tension on shaft **220** to keep is pressed into handle **210**. Handle **210** is configured to switch between a locked position and an unlocked position. In the locked position, driver **200** may receive impaction blows on its proximal end and transfer the energy from those blows directly to the blade extender **100** at the distal end. For example, if a surgeon desires to advance blade extender **100** into a disc space, a hammer or slap hammer may be used to gently pound against handle **210**. And when removing blade extender **100** from a disc space, handle **210** is configured to receive a slap hammer to facilitate pulling forces.

In the unlocked position, handle **210** can be translated distally causing shaft **220** to, in turn, translate distally. Distal end of shaft **220** is configured to engage with projection **125** of locking tab **120**. When shaft **220** translates distally, its distal end deflects locking tab **120** causing projection **125** to disengage from the distal end of the housing of driver **200**, thereby allowing blade extender **100** (or tissue shim **100**A or other suitable device) to be removed from driver **200**.

FIGS. **5**A and **5**B illustrate blade extender **100** coupled to or engaged with a retractor blade **300** that includes a channel **305** that runs from the proximal end of retractor blade **300** toward the distal end without extending all the way to the distal end. In other words, channel **305** is closed at the distal end such that a device, such as blade extender **100** translating along channel **305** could not exit the channel at the distal end but could be withdrawn at the proximal end. However, in some embodiments, channel **305** is open at the distal end.

FIG. **5**A illustrates that engagement tabs **115** extend into the lateral sides of channel **305**. In this configuration, engagement tabs **115** may be sized and designed to be in their resting or undeflected state when in channel **305**. Though, in some embodiments, even when engagement tabs **115** extend into the lateral sides of channel **305**, they are still at least partially deflected, which may be useful for fixing blade extender **100** in place relative to retractor blade **300**.

FIG. **5**A also illustrates that in this illustrated embodiment elongate portion **105** extends beyond the distal end of

retractor blade **300** when blade engagement portion **110** is at the distal-most position of channel **305**. The amount that elongate portion **105** extends beyond the distal end of retractor blade **300** is a function of the length of elongate portion **105** as well as the distance between the distal end of retractor blade **300** and the distal end of channel **305**. Although elongate portion **105** need not extend any distance beyond the distal end of retractor blade **300**, in some embodiments, the distance beyond the distal end of retractor blade **300** is from about 0.1 cm to about 5 cm. In some embodiments, that distance is about 1 cm, about 2 cm, about 3 cm, about 4 cm, or any value there between.

FIG. **5**B illustrates that channel **305** is defined not only as a depression in one side of retractor blade **300** but further includes a lateral lip **310** along each edge of the depression. The shape of channel **305** along with lateral lip **310**, as illustrated, is somewhat rounded; however, a square or rectangular shape could also be used. Also, channel **305** need not have a substantially flat surface at the bottom of the depression. In some embodiments, channel **305** is more rounded; however, channel **305** should still include lateral lip **310** if it is to be able to retain blade extender **100**.

FIG. **6** illustrates another variation on blade extender **100**, which is blade extender **100**B. Similar to blade extender **100**, blade extender **100**B includes an elongate portion **105**B and a blade engagement portion **110**B having two engagement tabs **115**B and a locking tab (not visible in this view) with a projection **125**B. The function of these features will be largely similar to the function of the corresponding features of blade extender **100** as discussed herein as would be readily apparent to a skilled artisan. However, blade extender **100**B includes a pair of tabs or ribs **135**B that extend downward or backward from blade engagement portion **110**B.

FIG. **7** illustrates a distal portion of a variation on driver **200**, which is referred to as driver **200**A, the distal end of which is labeled as **205**A. Distal end **205**A comprises three extensions or prongs **235**A, **240**A, and **245**A. Extension **235**A includes at its distal end a sloped surface **250**A and, proximal of sloped surface **250**A an opening **255**A. When blade extender **100**B is received by driver **200**A, opening **255**A receives projection **125**B so as to hold blade extender **100**B in a locked orientation relative to driver **200**A. In this illustrated embodiment, opening **255**A is a through-hole extending completely through extension **235**A; however, in some embodiments, the functionality of opening **255**A may be achieved with a notch or a cutout on the underside of extension **235**A.

Each of extensions **240**A and **245**A includes an outward-facing cutout configured to receive downward-facing tabs **135**B of blade extender **100**B. This design provides greater stability to blade extender **100**B when it is secured within driver **200**A.

FIG. **8** illustrates the engagement between driver **200**A and blade extender **100**B. Blade extender **100**B is secured to driver **200**A by sliding blade engagement portion **110**B into distal end **205**A of driver **200**A. A locked arrangement is achieved when blade extender **100**B is advanced far enough that projection **125**B is received by opening **255**A. In some embodiments, both extension **235**A and the locking tab of blade extender **100**B are comprised of one or more resilient materials that at least partially deflect when subject to a certain amount of pressure.

Driver **200**A includes a shaft (similar to shaft **220**) that is configured to be translatable along an axis defined by driver **200**A. The tip of the shaft applies a deflecting force to extension **235**A and/or the locking tab of blade extender **100**B so as to cause projection **125**B to be released from opening **255**A, thereby allowing blade extender **100**B to be released from driver **200**A.

FIG. **9** illustrates the proximal end of driver **200**A, which includes a trigger or release mechanism **260**A that is configured to manipulate the shaft contained within driver **200**A so as to control the release of blade extender **100**B from driver **200**A.

During a surgical procedure, a retractor assembly having at least one retractor blade is typically used to create a surgical corridor to reach a surgical site. A suitable method of utilizing extender blade **100** may include, first, advancing at least one retractor blade toward a surgical site so as to begin creating a surgical corridor to access a surgical site. A surgeon may desire to use a blade extender such as those disclosed herein to further stabilize the surgical corridor. This may be accomplished when first establishing the surgical corridor if the surgical corridor requires a depth greater than the length of the retractor blades. The blade extender may be advanced along a channel of the retractor blade, or the extender may be advanced directly into the surgical corridor and then, when ready to be affixed to the retractor blade, moved directly into the retractor blade's channel by pressing the extender into the channel in a direction perpendicular to the axis or plane of the channel.

Additionally, in some embodiments, the blade extenders disclosed herein may be advanced into an intradiscal space to temporarily anchor the retractor blade relative to the disc space.

The blade extenders disclosed herein may alternatively be used to restore a surgical corridor without the need to reposition the retractor blade, for example if tissue has crept around or under the retractor blades. In such a scenario, a suitable blade extender, such as blade extender **100**, is advanced into the surgical corridor, and the elongate portion **105** is used to push or pull back the errant tissue. Advancing blade extender **100** and manipulating it in the surgical corridor may be accomplished by first coupling blade extender **100** to a suitable driver, such as driver **200**. Blade extender **100** may also include a hook-shaped feature at its distal end or some other curvature or feature to grab errant tissue to pull it out of the surgical corridor.

In addition to using blade extender **100** (or **100**A or **100**B) to clear the surgical corridor, blade extender **100** may further maintain the surgical corridor. This is achieved while holding back the tissue. A surgeon inserts blade engagement portion **110** into a channel of the retractor blade, such as channel **305**, which may be achieved by advancing blade extender along channel **305** or by inserting blade extender **100** into channel **305** at a point toward the distal end of channel **305**. Pressing blade engagement portion **110** into channel **305** causes engagement tabs **115** to bend or deflect inward allowing blade engagement portion **110** to seat in channel **305**. When fully seated, engagement tabs **115** at least partially expand to fill the space between the sides of blade engagement portion **110** and the sides of channel **305**. If driver **200** is used to engage blade extender **100** in retractor blade **300**, driver **200** may also be inserted into channel **305**, and, if engagement tabs **215** are present, by forcing engagement tabs **215** to compress or bend inwardly to allow driver **200** to pass into channel **305**.

With blade extender **100** properly positioned in channel **305**, driver **200** is disengaged from blade extender **100** to be translated proximally along channel **305** leaving blade extender **100** in place in retractor blade **300**. This disengagement is achieved by rotating locking ring **210**.

Removal of blade extender **100** may be achieved by reinserting driver **200** into the proximal end of channel **305** and translating distal end **205** along channel **305** until distal end **205** engages with blade engagement portion **110** of blade extender **100**. When projection **125** engages with the locking mechanism of driver **200** contained within distal end **205**, driver **200** may then be translated proximally pulling blade extender **100** along with it and out of the surgical corridor.

This removal process may be used to readjust tissue within the surgical corridor, in which case, blade extender **100** may be again inserted into channel **305** after tissue in the corridor has been pulled to the side or the surgical site has been otherwise unobstructed.

In some embodiments, blade extender **100**, tissue shim **100**A, or some other suitable device that is consistent with the present disclosure is used to enhance the functionality of the retractor system with which these devices are used. For example, some retractor systems include retractor blades whose length is adjustable. Such adjustable blades may be bulky or complicated, and using the devices disclosed herein with a simple, non-adjustable blade results in essentially an adjustable blade that is not bulky or complicated.

Some retractor systems utilize releasable blades of different lengths and/or shapes instead of having adjustable blades. However, that solution requires the system to include many different blades, which increases manufacturing costs, transportation costs, etc. The use of the devices disclosed herein obviates the need for blades of different lengths because a single blade can achieve different lengths and even shapes if the devices disclosed herein are used. Moreover, the devices disclosed herein may be single-use or disposable.

Some retractor systems have complex mechanisms that allow the retractor blades to achieve a "level toe" movement as the blades are expanded. This is achieved by incrementally increasing the length of the blade as it is toed out, thereby minimizing the chance that tissue could creep under the blade tip as it is toed out. However, the present devices can be used to achieve a "level toe" movement by distally advancing the device—such as blade extender **100** or tissue shim **100**A—along the retractor blade as the blade or blades are toed out.

EMBODIMENTS

The following embodiments are provided as examples only of specific configurations, materials, arrangements, etc. contemplated by the authors of this disclosure:

Embodiment 1. A retractor blade device comprising:

a retractor blade engagement portion having a body portion with a distal end and a proximal end, the retractor blade engagement portion configured to sit at least partially in a channel of a retractor blade, the body portion having a first retention component extending therefrom; and

an extension portion having a distal end and a proximal end.

Embodiment 2. The retractor blade device of embodiment 1, wherein the extension portion is substantially flat or curved.

Embodiment 3. The retractor blade device of embodiment 1 or 2, wherein the extension portion has a hook feature.

Embodiment 4. The retractor blade device of embodiment 1, 2, or 3, wherein the extension portion is wider than the retractor blade engagement portion.

Embodiment 5. The retractor blade device of embodiment 1, 2, 3, or 4, wherein at least a portion of the extension portion extends laterally of the blade engagement portion.

Embodiment 6. The retractor blade device of embodiment 1, 2, 3, 4, or 5, wherein the distal end of the extension portion extends beyond the distal end of the blade engagement portion by at least about 1 cm, at least about 2 cm, at least about 3 cm, or at least about 4 cm.

Embodiment 7. The retractor blade device of embodiment 1, 2, 3, 4, 5, or 6, wherein the proximal end of the extension portion is positioned at any one of the following positions relative to the proximal and distal ends of the blade engagement portion: (a) proximally of the proximal end; (b) substantially in line with the proximal end; (c) substantially in line with the distal end; or (d) at a point between the proximal and distal ends.

Embodiment 8. The retractor blade device of embodiment 1, 2, 3, 4, 5, 6, 7, wherein the body portion defines a first plane, wherein the extension portion defines a second plane, and wherein the first and second planes are parallel to each other.

Embodiment 9. The retractor blade device of embodiment 8, wherein the first and second planes are not coplanar.

Embodiment 10. The retractor blade device of embodiment 1, 2, 3, 4, 5, 6, 7, 8, or 9, further comprising a second retention component.

Embodiment 11. The retractor blade device of embodiment 10, wherein the first retention component and/or the second retention component comprises a resilient projection.

Embodiment 12. The retractor blade device of embodiment 10 or 11, wherein the first retention component and/or the second retention component extends in a plane coplanar with the body portion.

Embodiment 13. The retractor blade device of embodiment 10, 11, or 12, wherein the first retention component and/or the second retention component is configured to engage at least a portion of a channel of a retractor blade.

Embodiment 14. The retractor blade device of embodiment 10, 11, 12, or 13, wherein the first retention component and/or the second retention component is configured to allow the retractor blade device to be brought into the channel from a position perpendicular to a plane defined by the channel.

Embodiment 15. The retractor blade device of embodiment 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, or 14, wherein the distal end of the extension portion has a rounded profile.

Embodiment 16. The retractor blade device of embodiment 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, or 15, wherein the extension portion comprises at least one scalloped edge.

Embodiment 17. The retractor blade device of embodiment 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, or 16, wherein the body portion further comprises a driver locking mechanism.

Embodiment 18. The retractor blade device of embodiment 17, wherein the driver locking mechanism comprises a resilient portion and a projection.

Embodiment 19. The retractor blade device of embodiment 18, wherein the projection is configured to engage a depression in a retractor blade.

Embodiment 20. The retractor blade device of embodiment 18 or 19, wherein the resilient portion lies substantially in the same plane as the body portion.

Embodiment 21. The retractor blade device of embodiment 18, 19, or 20, wherein the projection extends from a plane defined by the body portion.

Embodiment 22. The retractor blade device of embodiment 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17,

18, 19, 20, or 21, wherein the extension portion comprises a channel or track extending from a point near the proximal end of the extension portion toward the distal end of the extension portion.

Embodiment 23. The retractor blade device of embodiment 22, wherein the channel or track is open at its proximal end and/or open at its distal end.

Embodiment 24. The retractor blade device of embodiment 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22, or 23, wherein the body portion further comprises at least one tab extending therefrom.

Embodiment 25. The retractor blade device of embodiment 24, wherein the tab extends in a direction distinct from the direction in which the retention component extends.

Embodiment 26. The retractor blade device of embodiment 25, wherein the direction of the tab is normal to the direction of the retention component.

Embodiment 27. A blade device driver configured to engage a retractor blade device, the blade device driver comprising:

a handle;

an elongated housing;

a shaft contained within the housing; and

a receiving portion configured to receive at least a portion of the retractor blade device;

wherein the handle communicates with the shaft to releasably engage the retractor blade device.

Embodiment 28. The blade device driver of embodiment 27, wherein the retractor blade device is the retractor blade device of embodiment 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22, 23, 24, 25, or 26.

Embodiment 29. The blade device driver of embodiment 28, wherein the receiving portion comprises a distal opening in the housing configured to receive at least a portion of the body portion of the retractor blade device.

Embodiment 30. The blade device driver of embodiment 28 or 29, wherein the blade device driver is configured to releasably engage the driver locking mechanism of the retractor blade device.

Embodiment 31. The blade device driver of embodiment 27, 28, 29, or 30, wherein the housing comprises a first retention component configured to retain the blade device driver in a channel of a retractor blade.

Embodiment 32. The blade device driver of embodiment 31, wherein the housing comprises a second retention component configured to retain the blade device driver in the channel.

Embodiment 33. The blade device driver of embodiment 31 or 32, wherein the first retention component and/or the second retention component is configured to allow the blade device driver to be brought into the channel from a position perpendicular to a plane defined by the channel

Embodiment 34. The blade device driver of embodiment 28, 29, 30, 31, 32, or 33, wherein the handle is configured to occupy a locked position that allows compaction forces to be transferred from the handle through the housing and directly to the retractor blade device.

Embodiment 35. The blade device driver of embodiment 28, 29, 30, 31, 32, 33, or 34, wherein the receiving portion comprises three extensions: a locking extension and two receiving extensions—the locking extension configured to receive the driver locking mechanism of a retractor blade device and at least one of the two receiving extensions having a groove along at least portion of its length, the groove configured to receive the at least one tab of a retractor blade device.

Embodiment 36. The blade device driver of embodiment 35, wherein the three extensions of the receiving portion are parallel to each other.

Embodiment 37. The blade device driver of embodiment 27, 28, 29, 30, 31, 32, 33, 34, 35, or 36, wherein the handle comprises a trigger release mechanism that extends away from an axis defined by the shaft.

Embodiment 38. A retractor blade kit comprising:

a retractor blade defining a plane and having a proximal end and a distal end with a channel extending from the proximal end toward the distal end; and

a retractor blade device, at least a portion of the retractor blade device configured to engage with the channel of the retractor blade;

wherein the retractor blade device is configured to be engaged with the channel by inserting at least a portion of the retractor blade device into the channel at a point away from the proximal end of the retractor blade.

Embodiment 39. The retractor blade kit of embodiment 38, wherein the retractor blade device is the retractor blade device of embodiment 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22, 23, 24, 25, or 26.

Embodiment 40. The retractor blade kit of embodiment 38 or 39, wherein the channel is closed at the distal end of the retractor blade.

Embodiment 41. The retractor blade kit of embodiment 38, 39, or 40, wherein the channel is open at the proximal end of the retractor blade.

Embodiment 42. The retractor blade kit of embodiment 41, wherein the retractor blade device is further configured to be engaged with the channel by inserting at least a portion of the retractor blade device into the channel by accessing the opening of the channel at the proximal end of the retractor blade.

Embodiment 43. The retractor blade kit of embodiment 38, 39, 40, 41, or 42, further comprising a blade device driver configured to engage with at least a portion of the retractor blade device, wherein the blade device driver is further configured to manipulate the movement of the retractor blade device and engage the retractor blade device with the channel of the retractor blade.

Embodiment 44. The retractor blade kit of embodiment 43, wherein the blade device driver is the blade device driver of embodiment 27, 28, 29, 30, 31, 32, 33, 34, 35, 36, or 37.

Embodiment 45. A method of using a retractor blade device, the method comprising:

engaging the retractor blade device with a channel of a retractor blade by inserting at least a portion of the retractor blade device into the channel at a point distal to a proximal end of the channel.

Embodiment 46. The method of embodiment 45, wherein the retractor blade device is the retractor blade device of embodiment 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22, 23, 24, 25, or 26.

Embodiment 47. The method of embodiment 45 or 46, wherein engaging the retractor blade device with the channel of the retractor blade comprises moving the at least a portion of the retractor blade device in a direction normal to a plane defining the channel.

Embodiment 48. The method of embodiment 45, 46, or 47, wherein engaging the retractor blade device with the channel of the retractor blade comprises engaging at least a portion of the retractor blade device with one or more depressions in the channel of the retractor blade.

Embodiment 49. The method of embodiment 45, 46, 47, or 48, wherein the retractor blade is positioned within a surgical opening of a patient so as to create a surgical

corridor prior to the retractor blade device being engaged with the channel on the retractor blade.

Embodiment 50. The method of embodiment 49, further comprising sweeping the surgical corridor and/or a surgical site of interfering tissue with the retractor blade device prior to the retractor blade device being engaged with the channel of the retractor blade.

Embodiment 51. The method of embodiment 45, 46, 47, 48, 49, or 50, wherein the retractor blade and the retractor blade device comprise the retractor blade kit of embodiment 38, 39, 40, 41, 42, 43, or 44.

Embodiment 52. The method of embodiment 45, 46, 47, 48, 49, 50, or 51, wherein a blade device driver is used to insert the retractor blade device into the surgical corridor, manipulate the movement of the retractor blade device in the surgical corridor, and engage the retractor blade device with the channel of the retractor blade.

Embodiment 53. The method of embodiment 52, wherein the blade device driver is the blade device driver of embodiment 27, 28, 29, 30, 31, 32, 33, 34, 35, 36, or 37.

Embodiment 54. The method of embodiment 45, 46, 47, 48, 49, 50, 51, 52, or 53, further comprising toeing out the retractor blade while simultaneously advancing the retractor blade device distally along the channel of the retractor blade.

Embodiment 55. The method of embodiment 52, 53, or 54, further comprising detaching the blade device driver from the retractor blade device so as to leave the retractor blade device in the channel of the retractor blade while removing the blade device driver from the surgical corridor.

Embodiment 56. The method of embodiment 55, wherein removing the blade device driver from the surgical corridor comprising sliding the blade device driver proximally along the channel of the retractor blade and out a proximal opening of the channel.

While particular embodiments have been illustrated and described herein, it should be understood that various other changes and modifications may be made without departing from the spirit and scope of the claimed subject matter. Moreover, although various aspects of the claimed subject matter have been described herein, such aspects need not be utilized in combination.

Unless otherwise indicated, all numbers expressing quantities of ingredients, properties such as molecular weight, reaction conditions, and so forth used in the specification and claims are to be understood as being modified in all instances by the term "about." Accordingly, unless indicated to the contrary, the numerical parameters set forth in the specification and attached claims are approximations that may vary depending upon the desired properties sought to be obtained by the embodiments of the present disclosure. At the very least, and not as an attempt to limit the application of the doctrine of equivalents to the scope of the claims, each numerical parameter should at least be construed in light of the number of reported significant digits and by applying ordinary rounding techniques. Notwithstanding that the numerical ranges and parameters setting forth the broad scope of the present disclosure are approximations, the numerical values set forth in the specific examples are reported as precisely as possible. Any numerical value, however, inherently contains certain errors necessarily resulting from the standard deviation found in their respective testing measurements. In some embodiments, the terms "about" and "approximately" refer to numerical parameters within 10% of the indicated range.

The terms "a," "an," "the," and similar referents used in the context of describing the embodiments of the present disclosure (especially in the context of any claimed invention) are to be construed to cover both the singular and the plural, unless otherwise indicated herein or clearly contradicted by context. Recitation of ranges of values herein is merely intended to serve as a shorthand method of referring individually to each separate value falling within the range. Unless otherwise indicated herein, each individual value is incorporated into the specification as if it were individually recited herein. All methods described herein can be performed in any suitable order unless otherwise indicated herein or otherwise clearly contradicted by context. The use of any and all examples, or exemplary language (e.g., "such as") provided herein is intended merely to better illuminate the embodiments of the present disclosure and does not pose a limitation on the scope of the present disclosure. No language in the specification should be construed as indicating any non-claimed element essential to the practice of the embodiments of the present disclosure.

Groupings of alternative elements or embodiments disclosed herein are not to be construed as limitations. Each group member may be referred to and claimed individually or in any combination with other members of the group or other elements found herein. It is anticipated that one or more members of a group may be included in, or deleted from, a group for reasons of convenience and/or patentability. When any such inclusion or deletion occurs, the specification is deemed to contain the group as modified thus fulfilling the written description of all Markush groups used in the appended claims.

Certain embodiments are described herein, including the best mode known to the author(s) of this disclosure for carrying out the disclosed embodiments. Of course, variations on these described embodiments will become apparent to those of ordinary skill in the art upon reading the foregoing description. The author(s) expects skilled artisans to employ such variations as appropriate, and the author(s) intends for the embodiments of the present disclosure to be practiced otherwise than specifically described herein. Accordingly, this disclosure includes all modifications and equivalents of the subject matter recited in the claims appended hereto as permitted by applicable law. Moreover, any combination of the above-described elements in all possible variations thereof is encompassed by the present disclosure unless otherwise indicated herein or otherwise clearly contradicted by context.

Specific embodiments disclosed herein may be further limited in the claims using consisting of or consisting essentially of language. When used in the claims, whether as filed or added per amendment, the transition term "consisting of" excludes any element, step, or ingredient not specified in the claims. The transition term "consisting essentially of" limits the scope of a claim to the specified materials or steps and those that do not materially affect the basic and novel characteristic(s). Embodiments of this disclosure so claimed are inherently or expressly described and enabled herein.

Furthermore, if any references have been made to patents and printed publications throughout this disclosure, each of these references and printed publications are individually incorporated herein by reference in their entirety.

In closing, it is to be understood that the embodiments disclosed herein are illustrative of the principles of the present disclosure. Other modifications that may be employed are within the scope of this disclosure. Thus, by way of example, but not of limitation, alternative configurations of the embodiments of the present disclosure may be utilized in accordance with the teachings herein. Accord-

ingly, the present disclosure is not limited to the embodiments precisely as shown and described.

The invention claimed is:

1. A retractor blade device comprising:

a retractor blade engagement portion having a body portion with a distal end and a proximal end, the retractor blade engagement portion configured to sit at least partially in a channel of a retractor blade, the body portion having first and second retention components comprising resilient projections, each component extending laterally therefrom to engage respective lateral edges of the channel; and

an extension portion having a distal end and a proximal end;

wherein the first and second retention components extend in a plane coplanar with the body portion; and

wherein the first and second retention components are configured to allow the retractor blade device to be brought into the channel from a position perpendicular to a place defined by the channel.

2. The retractor blade device of claim **1**, wherein the extension portion has a hook feature.

3. The retractor blade device of claim **1**, wherein the extension portion is wider than the retractor blade engagement portion.

4. The retractor blade device of claim **1**, wherein at least a portion of the extension portion extends laterally relative to the blade engagement portion.

5. The retractor blade device of claim **1**, wherein the body portion defines a first plane, wherein the extension portion defines a second plane, and wherein the first and second planes are parallel to each other.

6. The retractor blade device of claim **5**, wherein the first and second planes are not coplanar.

7. The retractor blade device of claim **1**, wherein the extension portion comprises at least one scalloped edge.

8. The retractor blade device of claim **1**, wherein the body portion further comprises a driver locking mechanism.

9. The retractor blade device of claim **8**, wherein the driver locking mechanism comprises a resilient portion and a projection.

10. The retractor blade device of claim **9**, wherein the projection is configured to engage a depression in a retractor blade.

11. The retractor blade device of claim **10**, wherein the resilient portion lies substantially in the same plane as the body portion.

12. The retractor blade device of claim **11**, wherein the projection extends from a plane defined by the body portion.

13. The retractor blade device of claim **1**, wherein the extension portion comprises a channel or track extending from a point near the proximal end of the extension portion toward the distal end of the extension portion.

14. The retractor blade device of claim **13**, wherein the channel or track is open at its proximal end.

15. The retractor blade device of claim **1**, wherein the body portion further comprises at least one tab extending therefrom.

16. The retractor blade device of claim **15**, wherein the tab extends in a direction distinct from the direction in which the retention components extend.

17. The retractor blade device of claim **16**, wherein the direction of the tab is normal to the direction of the retention components.

18. The retractor blade device of claim **1**, wherein the extention portion includes a curved surface.

19. The retractor blade device of claim **18**, wherein the curved surface curves in a direction away from a plane defined by retractor blade engagement portion.

20. The retractor blade device of claim **18**, wherein the extention portion includeds a second channel extending in the same direction as the channel of the retractor blade but defining a plane that is not coplanar with the channel of the retractor blade.

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